



Test Report: PWM-120-36

120W PWM Output LED Driver

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

Environment Test



DESIGN VERIFY TEST

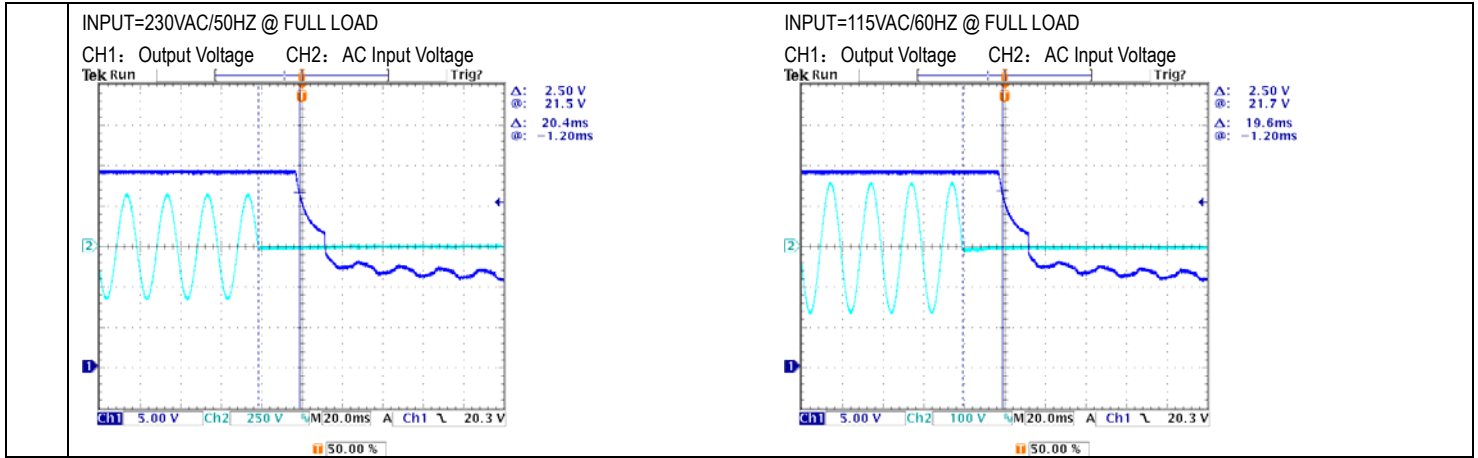
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM FREQUENCY	1.47KHz	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	1.479KHz
2	OVER/UNDERSHOOT TEST	<± 5 %	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	<5 %
3	SET UP TIME(Max)	230VAC/ 500ms 115VAC/ 500ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/ 334ms 115VAC/ 372ms
<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1: Output Voltage CH2: AC Input Voltage</p> <p>Δ: 23.5 V @: 23.8 V Δ: 334ms @: 0.00 s</p> </div> <div style="width: 45%;"> <p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1: Output Voltage CH2: AC Input Voltage</p> <p>Δ: 23.6 V @: 23.8 V Δ: 372ms @: 0.00 s</p> </div> </div>				
4	RISE TIME (Max)	230VAC/ 80ms 115VAC/ 80ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/0.081ms 115VAC/0.081ms
<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1: Output Voltage</p> <p>Ch1 Rise 80.64μs Low resolution</p> </div> <div style="width: 45%;"> <p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1: Output Voltage</p> <p>Ch1 Rise 80.99μs Low resolution</p> </div> </div>				
5	HOLD UP TIME(Typ)	230VAC/ 16ms 115VAC/ 16ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta: 25°C	230VAC/20.4ms 115VAC/19.6ms



120W PWM Output LED Driver

PWM-120 series

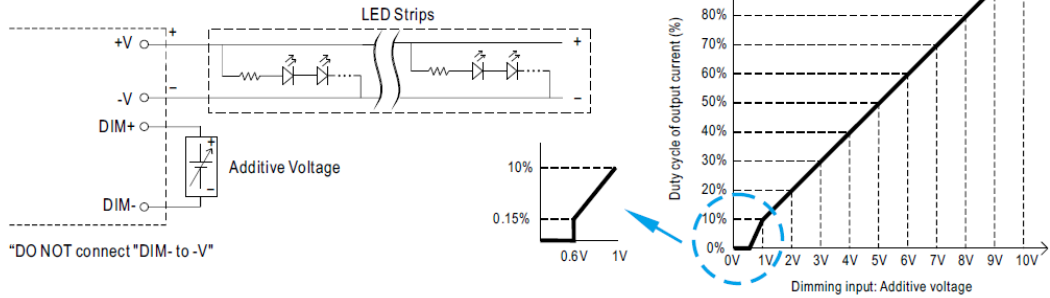


6 DIMMING TEST(for Blank-Type)

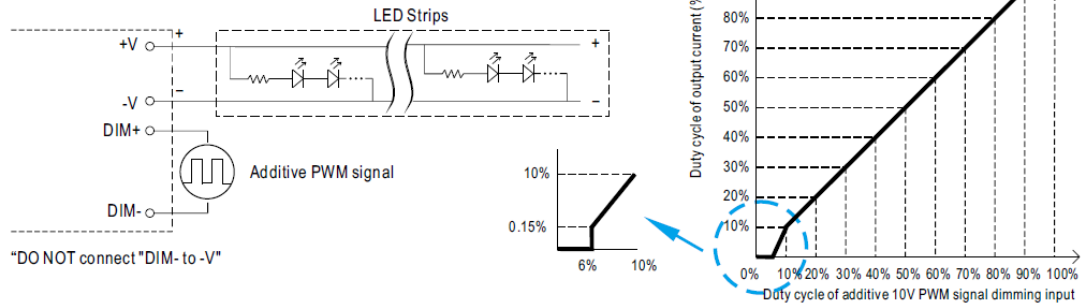
※ 3 in 1 dimming function (for Blank-Type)

- Apply one of the three methodologies between DIM+ and DIM-: 0 ~ 10VDC, or 10V PWM signal or resistance.
- Dimming source current from power supply: 100 μ A (typ.)

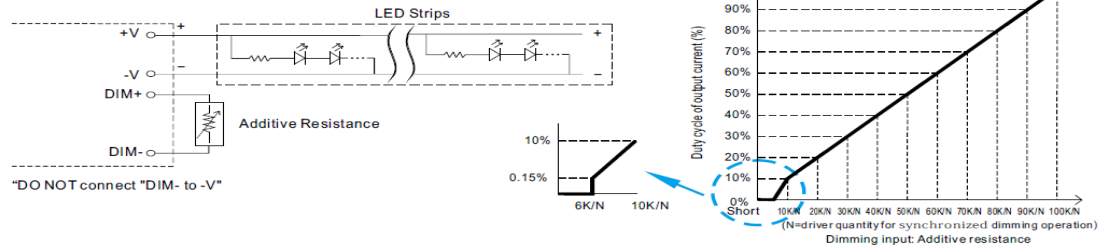
◎ Applying additive 0 ~ 10VDC



◎ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):



◎ Applying additive resistance:



Note : 1. Min. duty cycle of output current is about 0.15%, and the dimming input is about 6K Ω or 0.6VDC, or 10V PWM signal with 6% duty cycle.
 2. The duty cycle of output current could drop down to 0% when dimming input is less than 6K Ω or less than 0.6VDC, or 10V PWM signal with duty cycle less than 6%.

I/P: 230 VAC; O/P: DIMMING TEST; Ta: 25 $^{\circ}$ C

1	Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	Output Current	0	0.372	0.696	1.020	1.343	1.666	1.990	2.313	2.636	2.960	3.449	3.449
Output Current duty	0%	10.94 %	20.47 %	30.00 %	39.50 %	49.00 %	58.53 %	68.03 %	77.53 %	87.06 %	101.44 %	101.44 %	
2	Dimming value	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
	Output Current	0	0.381	0.708	1.023	1.352	1.674	2.007	2.332	2.650	2.976	3.449	3.449
	Output Current duty	0%	11.21 %	20.82 %	30.09 %	39.76 %	49.24 %	59.03 %	68.59 %	77.94 %	87.53 %	101.44 %	101.44 %
3	Duty value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	Output Current	0	0.383	0.713	1.025	1.345	1.667	1.987	2.307	2.629	2.947	3.384	3.449
	Output Current duty	0%	11.26 %	20.97 %	30.15 %	39.56 %	49.03 %	58.44 %	67.85 %	77.32 %	86.68 %	99.53 %	101.44 %



120W PWM Output LED Driver

PWM-120 series

7	DALI DIMMING OPERATION (primary side; for DA-Type)	※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·First step is fixed at 6% of output. I/P: 230 VAC O/P: DIMMING TEST Ta: 25°C TEST RESULT: OK
---	---	---

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	87V~305V
			I/P: (1)LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P: FULL/NO LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230VAC ON: 0.5 Sec OFF: 0.5 Sec 20MIN	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 90 VAC ~305 VAC O/P: FULL~NO LOAD Ta: 25°C	TEST: OK
3	AC CURRENT	1.3A/115VAC 0.65A/230VAC 0.55A/277VAC	I/P: 115 VAC I/P: 230 VAC I/P: 277 VAC O/P: FULL LOAD Ta: 25°C	I =1.172A/ 115VAC I =0.590A/ 230VAC I =0.503A/ 277VAC
4	LEAKAGE CURRENT	< 0.25mA / 277VAC	I/P: 277 VAC O/P: NO LOAD Ta: 25°C	L-FG: 0.003 mA N-FG: 0.003 mA
5	NO LOAD/STANDBY POWER CONSUMPTION	< 0.5W	I/P: 230VAC O/P: NO LOAD Ta: 25°C	0.373W
6	TOTAL HARMONIC DISTORTION	THD < 20% (@load ≥ 60%/115VAC, 230VAC; @load ≥ 75%/277VAC)	I/P: 115 VAC/60% LOAD I/P: 230 VAC/60% LOAD I/P: 277 VAC/75% LOAD Ta: 25°C	THD: 6.45 %@60% load /115VAC THD: 14.25 %@60% load /230VAC THD: 17.33 %@75% load /277VAC

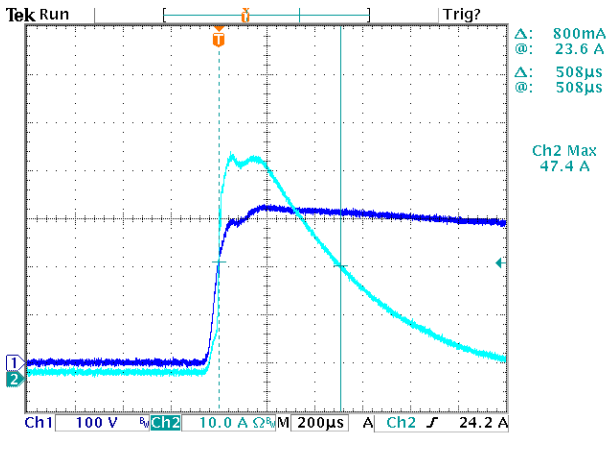


120W PWM Output LED Driver

PWM-120 series

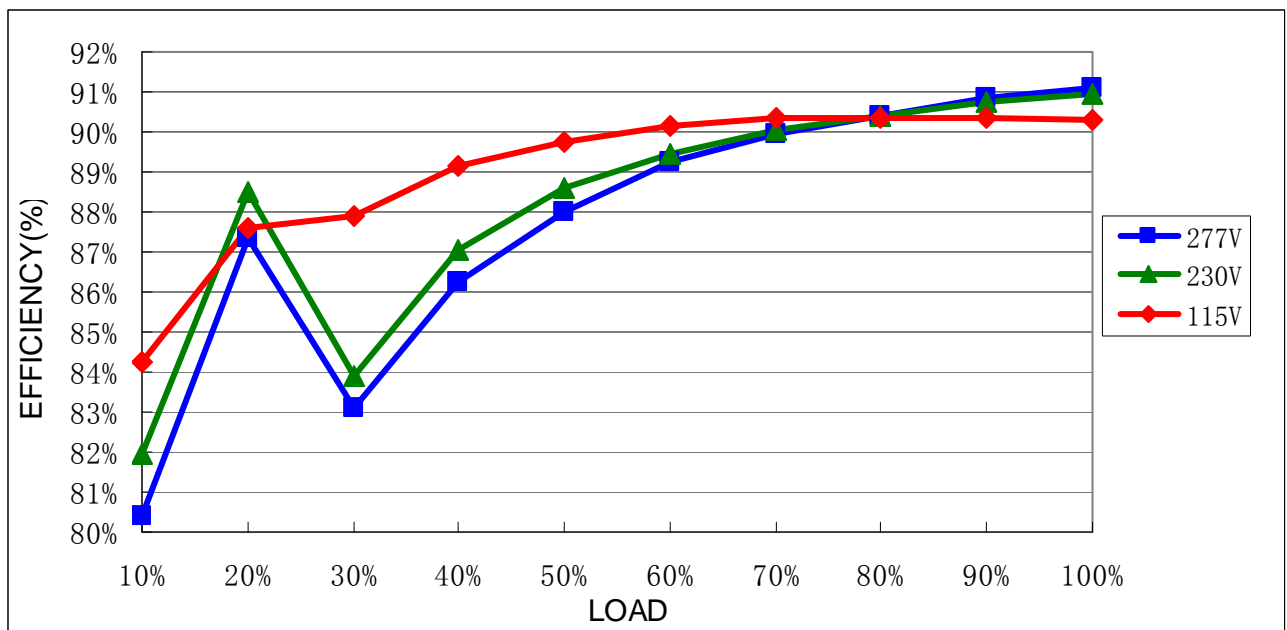
7	INRUSH CURRENT(Typ)	60A/230VAC Twidth =520 us measured at 50% Ipeak COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I=47.4A/ 230VAC Twidth =508us
---	---------------------	---	--	----------------------------------

INPUT=230VAC/50HZ @ FULL LOAD
CH2: Input current CH1: AC Input Voltage



8	EFFICIENCY(Typ)	90%	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	90.97%
---	-----------------	-----	---	--------

EFFICIENCY vs LOAD



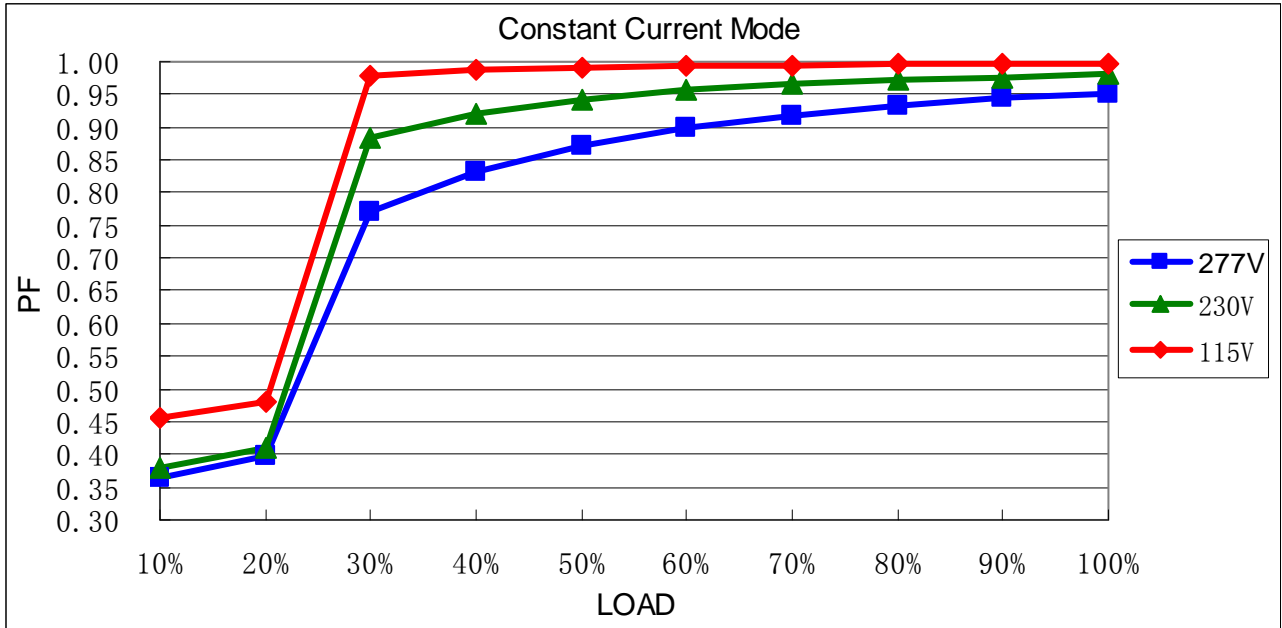


120W PWM Output LED Driver

PWM-120 series

9	POWER FACTOR	0.97/ 115VAC	I/P: 115 VAC	PF=0.997/ 115VAC
		0.96/ 230VAC	I/P: 230 VAC	PF=0.980/ 230VAC
		0.94/ 277VAC	I/P: 277 VAC	PF=0.952/ 277VAC
			O/P: FULL LOAD	
			Ta: 25°C	

P.F vs LOAD



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	108%~ 120 %	I/P: 230VAC O/P: TESTING Ta: 25°C	115.65%/ 230VAC Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	41V~46V	I/P: 230VAC O/P: NO LOAD Ta: 25°C	43.50V/ 230VAC Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 230 VAC O/P: FULL LOAD	O.T.P. Active Shut down o/p voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 295VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Shut down o/p voltage, re-power on to recover



COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 2 Rated 730V/10A	I/P: High-Line +3V =308V O/P: (1) Full Load Turn on (2) Output Short (3) Full load continue Ta: 25°C	(1) 720V (2) 712V (3) 684V
2	Diode Peak Voltage	Q101 Rated 200V/20A	I/P: High-Line +3V =308V O/P: (1) Full Load Turn on (2) Output Short (3) Full load continue Ta: 25°C	(1) 186V (2) 182V (3) 182V
3	Input Capacitor Voltage	C5 Rated 100u/ 450V	I/P: High-Line +3V =308 V O/P: (1) Full Load input on/off (2) NO load input on /Off (3) Full Load /NO load Change Ta: 25°C	(1) 444V (2) 440V (3) 444V
4	Control IC Voltage Test	U1 Rated 28V	I/P: High-Line +3V =308 V O/P: (1) Full Load input on/off (2) NO load input on /Off (3) Full Load /NO load Change Ta: 25°C	(1) 17.3V (2) 17.1V (3) 17.2V
5	PFC Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 600V/15A	I/P: High-Line +3V =308V O/P: (1) Full Load Turn on (2) Output Short (3) Full load continue Ta: 25°C	(1) 478V (2) 458V (3) 476V



SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min	I/P-O/P: 4.2KVAC/min Ta: 25°C	I/P-O/P: 1.883mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P: 500VDC>100MΩ	I/P-O/P: 500VDC Ta: 25°C	I/P-O/P: >9999MΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230VAC/50HZ O/P: 60%/FULL LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
3	RADIATION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR: 8KV Contact: 4KV	I/P: 230 VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
6	SURGE	EN61000-4-5 INDUSTRY L-N: 2KV	I/P: 230 VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
7	Test by certified Lab & Test Report Prepare			



RELIABILITY TEST

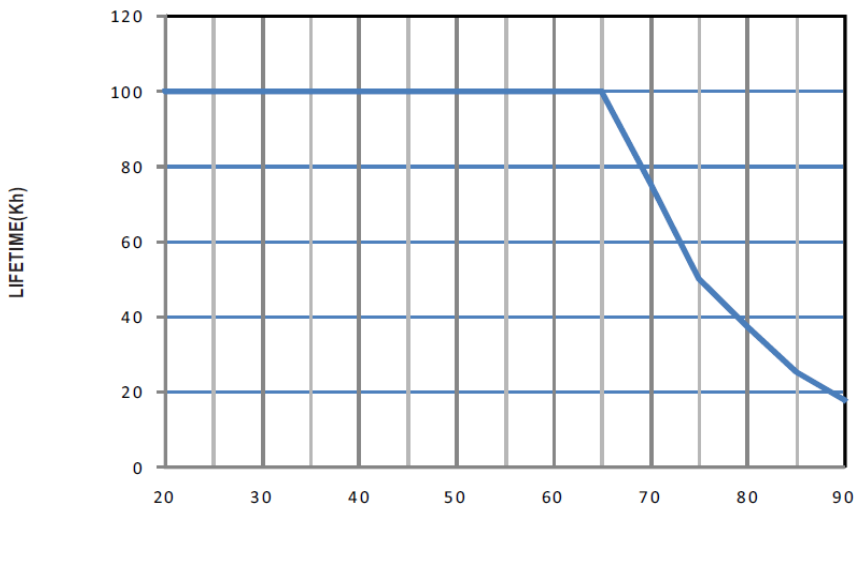
ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																
1	TEMPERATURE RISE TEST	MODEL: PWM-120-36 1. ROOM AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: FULL LOAD Ta= 30.5℃ 2. HIGH AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: FULL LOAD Ta= 46.2℃																																																																																		
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 30.5 ℃</th> <th>HIGH AMBIENT Ta=46.2 ℃</th> </tr> </thead> <tbody> <tr><td>1</td><td>C110</td><td>59.8℃</td><td>73.1℃</td></tr> <tr><td>2</td><td>Q105</td><td>63.2℃</td><td>76.4℃</td></tr> <tr><td>3</td><td>C5</td><td>72.3℃</td><td>85.9℃</td></tr> <tr><td>4</td><td>C11</td><td>73.1℃</td><td>87.5℃</td></tr> <tr><td>5</td><td>C105</td><td>68.9℃</td><td>82.0℃</td></tr> <tr><td>6</td><td>T1</td><td>77.8℃</td><td>95.8℃</td></tr> <tr><td>7</td><td>RTH2</td><td>75.6℃</td><td>88.7℃</td></tr> <tr><td>8</td><td>Q1</td><td>75.6℃</td><td>90.4℃</td></tr> <tr><td>9</td><td>Q2</td><td>81.5℃</td><td>97.2℃</td></tr> <tr><td>10</td><td>Q101</td><td>73.8℃</td><td>86.8℃</td></tr> <tr><td>11</td><td>RTH1</td><td>60.3℃</td><td>72.0℃</td></tr> <tr><td>12</td><td>D10</td><td>85.8℃</td><td>101.8℃</td></tr> <tr><td>13</td><td>C45</td><td>69.7℃</td><td>83.2℃</td></tr> <tr><td>14</td><td>U1</td><td>68.5℃</td><td>82.3℃</td></tr> <tr><td>15</td><td>R7</td><td>82.9℃</td><td>97.8℃</td></tr> <tr><td>16</td><td>C15</td><td>85.5℃</td><td>99.9℃</td></tr> <tr><td>17</td><td>C12</td><td>75.7℃</td><td>90.1℃</td></tr> <tr><td>18</td><td>RTH3</td><td>67.6℃</td><td>81.1℃</td></tr> <tr><td>19</td><td>TC</td><td>62.5℃</td><td>76.6℃</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 30.5 ℃	HIGH AMBIENT Ta=46.2 ℃	1	C110	59.8℃	73.1℃	2	Q105	63.2℃	76.4℃	3	C5	72.3℃	85.9℃	4	C11	73.1℃	87.5℃	5	C105	68.9℃	82.0℃	6	T1	77.8℃	95.8℃	7	RTH2	75.6℃	88.7℃	8	Q1	75.6℃	90.4℃	9	Q2	81.5℃	97.2℃	10	Q101	73.8℃	86.8℃	11	RTH1	60.3℃	72.0℃	12	D10	85.8℃	101.8℃	13	C45	69.7℃	83.2℃	14	U1	68.5℃	82.3℃	15	R7	82.9℃	97.8℃	16	C15	85.5℃	99.9℃	17	C12	75.7℃	90.1℃	18	RTH3	67.6℃	81.1℃	19	TC	62.5℃	76.6℃		
NO	Position	ROOM AMBIENT Ta= 30.5 ℃	HIGH AMBIENT Ta=46.2 ℃																																																																																	
1	C110	59.8℃	73.1℃																																																																																	
2	Q105	63.2℃	76.4℃																																																																																	
3	C5	72.3℃	85.9℃																																																																																	
4	C11	73.1℃	87.5℃																																																																																	
5	C105	68.9℃	82.0℃																																																																																	
6	T1	77.8℃	95.8℃																																																																																	
7	RTH2	75.6℃	88.7℃																																																																																	
8	Q1	75.6℃	90.4℃																																																																																	
9	Q2	81.5℃	97.2℃																																																																																	
10	Q101	73.8℃	86.8℃																																																																																	
11	RTH1	60.3℃	72.0℃																																																																																	
12	D10	85.8℃	101.8℃																																																																																	
13	C45	69.7℃	83.2℃																																																																																	
14	U1	68.5℃	82.3℃																																																																																	
15	R7	82.9℃	97.8℃																																																																																	
16	C15	85.5℃	99.9℃																																																																																	
17	C12	75.7℃	90.1℃																																																																																	
18	RTH3	67.6℃	81.1℃																																																																																	
19	TC	62.5℃	76.6℃																																																																																	
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P: 305VAC/100VAC O/P: FULL LOAD Ta= -45℃ / -30℃	TEST: OK																																																																																
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45 ℃ NO DAMAGE	I/P: 315VAC O/P: FULL LOAD Ta=45 ℃ HUMIDITY= 95% R.H	TEST: OK																																																																																
4	TEMPERATURE COEFFICIENT	±0.03%/℃ (0~50℃)	I/P: 230 VAC O/P: FULL LOAD	±0.003%/℃ (0~50℃)																																																																																
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature: -45℃~ +85℃ 2. Temperature change rate : 25℃ / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle: 5 CYCLE 5. Input/Output condition: STATIC		TEST: OK																																																																																



120W PWM Output LED Driver

PWM-120 series

6	THERMAL SHOCK TEST	1. Thermal shock Temperature: -45°C~ +50°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle: 10 CYCLE 5. Input/Output condition: 230VAC/Full Load AC ON/OFF TEST turn on 58 sec, turn off 2 sec;	TEST: OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform: Sine Wave (2) Frequency: 10~500Hz (3) Sweep Time: 12min/sweep cycle (4) Acceleration: 5G (5) Test Time: 72min in each axis (X.Y.Z) (6) Ta: 25°C	TEST: OK
8	CAPACITOR LIFE CYCLE	PWM-120-36: SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P: 230VAC O/P: FULL LOAD Ta= 25 °C LIFE TIME (2) I/P: 230VAC O/P: FULL LOAD Ta= 45 °C LIFE TIME (3) I/P: 230VAC O/P: 75% LOAD Ta= 45 °C LIFE TIME (4) I/P: 230VAC O/P: 50% LOAD Ta= 45 °C LIFE TIME	(1) 216348 HRS (2) 45738 HRS (3) 60016 HRS (4) 94864 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 860.4K hrs min. Telcordia SR-332 (Bellcore) 228.7K hrs min. MIL-HDBK-217F (25°C)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50000 hours @ TC 75°C 	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	ZHANGZJ/ZHUOKB	SKY	LIUWY